SPACE TECHNOLOGY

Industrial and Commercial Applications

VOLUME 14 1994

VOLUME CONTENTS AND AUTHOR INDEX

PERGAMON

SPACE TECHNOLOGY
Industrial and Commercial Applications
An International Journal

Editor-in-Chief
Professor R. MONTI
Institute of Aerodynamics, Naples University, P. le V. Tecchio 80, 80125 Naples, Italy

Founding Editor
Professor L. G. NAPOLITANO

Managing Editor
R. Fortezza, MARS Center, Via Diocleziano 328, 80125 Naples, Italy

Associate Editors
P. Castruccio, Ecosystem, P.O. Box 225, Gambrills, MD 21054, U.S.A.
B. J. Edelson, George Washington University, EECS, Room T-644, Washington, DC 20052, U.S.A.
E. Galloway, 4612 29th Place NW, Washington, DC 20008, U.S.A.
A. Lebeau, 2 Avenue Jeanne d'Arc, 94110 Arcueil, France
G. Pardoe, General Technology Systems Ltd, Brunel Science Park, Kingston Lane, Uxbridge, Middlesex UB8 3PQ, U.K.
G. Seibert, ESA Headquarters, 8–10 rue Mario Nikis, F-75738 Paris Cedex 15, France

Editorial Advisory Board
D. Abir, Tel-Aviv University, School of Engineering, Tel-Aviv 69978, Israel
E. V. Benton, Physics Dept, San Francisco University, San Francisco, CA 94117, U.S.A.
C. Buongiorno, Agenzia Spaziale Italiana, Viale Regina Margherita 202, 00198 Rome, Italy
C. Ciliberto, Rector of Naples University, Naples, Italy
M. B. Collins, Department of Oceanography, The University, Southampton SO9 5NH, U.K.
H. Curien, 24 Rue de Sasset-S. Jacques, 75005 Paris, France
S. Dahwan, ISRO Headquarters, Cauvery Bhavon, District Office Road, Bangalore 560 009, India
J. Fellows, British National Space Centre, R16 Building, Royal Aerospace Establishment, Farnborough, Hants GU14 6TD, U.K.
R. Gibson, Residence les Hesperides, 51 allée Jean de Beins, F-34000 Montpellier, France
G. Greger, Federal Ministry for Research & Technology, Postfach 20076, D-5300 Bonn 2, Germany
L. Guerriero, Agenzia Spaziale Italiana, Via di Villa Patriza 13, 00161 Rome, Italy
J. D. Hodge, International Management & Aerospace Consultants, 1105 Challedon Road, Great Falls, VA 22066, U.S.A.
C. de Jager, Laboratorium voor Ruimte-Onderzoek, Sorbonnel 2, NL-3584 CA Utrecht, The Netherlands
J. S. MacDonald, MacDonald Dettwiler, 13800 Commerce Parkway, Richmond, B.C., Canada V6V 2J3
R. Malina, 95 Hiller Drive, Oakland, CA 94618-2350, U.S.A.
H. Ochiai, Toba Merchant Marine College, Toba City, Mie-ken, Japan
W. L. Pritchard, Satellite Systems Engineering Inc., Suite 521E, 7315 Wisconsin Avenue, Washington, DC 20014, U.S.A.
A. Pryor, Director General, British National Space Centre, Room 803, Millbank Tower, London SW1P 4QU, U.K.
K. Serafimov, Department of Astronomy, National Astronomical Observatory, 72 Lenin Blvd, 1784 Sofiya, Bulgaria
M. Trella, ESA Headquarters, 8–10 rue Mario Nikis, F-75738 Paris Cedex 15, France
E. Vallerani, Alenia Spazio, Corso Marche 41, 10146 Torino, Italy

Publishing Office
Elsevier Science Ltd, Bampfylde Street, Exeter EX1 2AH, England [*Tel.* Exeter (01392) 51558; *Fax* (01392) 425370].

Production Editor: Nigel J. Stoneman

Subscription and Advertising Office
North America: Elsevier Science Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A.; *Rest of the World*: Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, England [*Tel.* Oxford (01865) 843000; *Fax* (01865) 843010].

Published 6 issues/annum in January, March, May, July, September, November

Subscription Rates
Annual Institutional Subscription Rates 1995: North, Central and South America, US$559.00. Rest of the World, £375.00. Associated Personal Subscription Rates are available on request for those whose institutions are library subscribers. Sterling prices exclude VAT. Non-VAT registered customers in the European Community will be charged the appropriate VAT in addition to the price listed. Prices include postage and insurance and are subject to change without notice.

Back Issues
Back issues of all previously published volumes are available direct from Elsevier Science Offices (Oxford and New York). Complete volumes and single issues can be purchased for 1990–1994. Earlier issues are available in high quality photo-duplicated copies as complete volumes only.

Copyright © 1995 Elsevier Science Ltd

Second class postage paid at NEWARK, NJ. Postmaster send address corrections to *Space Technology*, c/o Elsevier Science Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A.

VOLUME CONTENTS

Volume 14, Number 1

Roger Handberg, Joan Johnson-Freese and **Bill Nelson**	1	The Space Station, NASA and Congress: micro-managing space policy
Toru Tanabe and **Shinichi Nakasuka**	11	Fuel station-based transportation network as a future space infrastructure
J. Lassmann	21	Low cost heavy lift launch vehicle for lunar exploration based on the Energia launcher
Steven J. Schneider	31	Low thrust chemical rocket technology
Scott A. Carpenter and **Marc E. Deveny**	45	Mirror Fusion Propulsion System (MFPS): an option for the Space Exploration Initiative (SEI)
John R. Brophy	73	A segmented ion engine design for solar electric propulsion systems
William J. D. Escher	81	Prospective new transportation application initiatives in NASA's Earth-to-Orbit Propulsion Technology Program
Charles A. Lindley and **Jay Penn**	99	Combined exo/endo-atmospheric transport alternatives

Volume 14, Number 2/3

COLUMBUS IX SYMPOSIUM ON SPACE STATION UTILIZATION

Ernesto Vallerani and **Bernd Sträter**	109	The Columbus industrial organization—Euro-columbus
W. Frank, N. Gargir and **D. Salt**	115	Tactical Operations Planning and Increment Management Centre—TOPIC
Raimondo Fortezza	147	Telescience experience at MARS Center
K. Knott	157	The Columbus External Viewing Platform (EVP)
G. Rum, C. Canu, L. Battocchio, M. Cardano and **M. Tripoli**	161	The Columbus APM-Centre: an integrated ground facility to provide enhanced user support
M. C. Limbourg	167	Telescience—the Belgian Space Remote Operation Centre

P. Goldsmith and **C. J. Readings**	173	Earth observation
R. Jönsson	177	European User Support Organisation concept description and implementation plan
F. B. Visser, M. P. A. M. Bronwer and **E. A. Kuypers**	183	Space for the user, DUC in the Netherlands
Y. Malméjac	193	Scientific utilization of Columbus—life sciences
C. Mirra, Th. A. E. Andersen, G. Laborde, M. C. Limbourg, J. Ortiz, B. Visser and **K. Wittmann**	199	European User Support Centers Report
A. M. Hieronimus-Leuba and **Ph. Willekens**	207	RADIUS—Research Association for the Development of Industrial Use of Space: a new incentive for non-aerospace industries to participate in space utilisation activities
Franco Rossitto	211	Preparation for long-duration missions
Uwe Christ	213	Interconnection Ground Subnetwork
J. Howieson, M. Uggiano, M. Wolff and **W. Ockels**	225	Columbus utilisation simulations in the ESTEC Crew Workstation Test-Bed
Joachim Kehr and **Richard van Holtz**	231	European Payload Operations Coordination Center (E-POCC)
E. Bennett, G. Schmitz, K. Wittmann, F. Limburger and **J. C. Degavre**	241	HOLOP D-2 telescience: first results
I. Braga and **W. De Peuter**	245	The Automation and Robotics Testbed (CAT)

Volume 14, Number 4

Masafumi Miyazawa, Yukio Fukushima, Hiroshi Miyaba, Tateo Hosomura and **Tatsuro Asai**	249	Japan's new solid rocket booster and its derivative launcher
Robert M. Zubrin, Steve Price, Terry Gamber, Ben Clark and **Jim Cantrell**	261	The Mars Aerial Platform mission
James G. Watzin	269	NASA's Small Explorer spacecraft—flight proven, high performance, reliable and still small

D. Pawlak, P. Villefranche, O. Pace, C. Winkler, A. Dean, J. Matteson and **R. Sunyaev** 281 INTEGRAL: exploring the gamma-ray frontier

P. Eymar, G. Schneider and **G. Viriglio** 293 Future global space infrastructure and possible European involvement

Volume 14, Number 5

A. F. Gearing, B. I. McKissock, S. A. Cookson, P. R. Ahlf and **E. K. Huckins III** 299 U.S./Russian cooperation on Space Station: the NASA/NPO Energia studies contract

K. Shiraki, K. Ozawa, T. Matsueda, K. Goma, Y. Sugasawa and **R. Okamura** 307 JEMRMS development status

Douglas O. Stanley and **William M. Piland** 319 Technology requirements for affordable single-stage rocket launch vehicles

V. Badescu 331 Dynamic solar space power systems: optimum design and operation

K. R. Sridhar and **S. A. Miller** 339 Solid oxide electrolysis technology for ISRU and life support

Volume 14, Number 6

J. Brochard-Runavot 347 The international management of the MARS 94/96 mission: the French Space Agency role

William C. Snoddy, Max E. Nein and **John D. Hilchey** 355 Design considerations and strategies for lunar-based observations

Fritz W. Gampe 367 ESA in-house activities on small missions, architecture and advanced service concepts

R. J. Hung and **H. L. Pan** 381 Sloshing dynamics modulated angular momentum fluctuations actuated by gravity gradient acceleration associated with spacecraft slew motion

Axel E. Hammesfahr, Hubert Salmen and **Bernd Schürenberg** 391 An X-ray mirror assembly for XMM based on carbon fiber technology